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New records of *Clauzadea* and *Immersaria* from ChinaLU-LU ZHANG[#], LING HU[#], XIANG-XIANG ZHAO, & ZUN-TIAN ZHAO^{*}

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ABSTRACT —Three lichen species in the *Lecideaceae* (*Clauzadea monticola*, *Immersaria iranica*, *I. usbekica*) are reported for the first time from China.

KEY WORDS —*Lecideales*, Asia, taxonomy

Introduction

Lecideaceae Chevall. (Chevallier 1826, as ‘*Lecideae*’) originally included all crustose lecideoid lichen genera but now consists of relatively few genera with (crypto-)lecideine or (crypto-)lecanorine apothecia, mostly simple hyaline ascospores, and a *Lecidea*-type or *Porpidia*-type ascus structure. Currently the family contains about 23 genera and 547 species, of which the largest genus is *Lecidea* Ach., containing about 427 species (Kirk et al. 2008, Fryday & Hertel 2014). Two species of *Immersaria* Rambold & Pietschm. have been reported from China (Hertel 1977, Wei 1991; Aptroot & Sparrius 2003; Obermayer 2004) but no species of *Clauzadea* Hafellner & Bellem.

Clauzadea and *Immersaria* are closely related and are both characterized by a *Porpidia*-type ascus, $\pm$ halonate ascospores, and branched paraphyses. *Immersaria* can best be distinguished by its thick brown areolate thallus with a distinct epinecral layer, its immersed lecideine or lecanorine apothecia, and its siliceous or calcareous habitat, while *Clauzadea* has only lecideine apothecia and is restricted to calcareous rock (Rambold 1989, Thomson 1997, Calatayud & Rambold 1998, Smith et al. 2009, Valadbeigi et al. 2011).

During our research on the lecideoid taxa in China, we identified three species new to the country: *Clauzadea monticola*, *Immersaria iranica*, and *I. usbekica*.

[#]Lu-Lu Zhang & Ling Hu contributed equally.

Materials & methods

The studied specimens are preserved in the Lichen Section of the Botanical Herbarium, Shandong Normal University, Jinan, China (SDNU). Morphological and anatomical characters were examined under a stereo-microscope (COIC XTL7045B2) and a polarizing microscope (OLYMPUS CX41). The thalli and medullae were tested for identification with K (10% aqueous KOH solution), C (saturated aqueous NaClO solution), I (10% aqueous IKI solution), and P (saturated *p*-phenylenediamine solution in 95% ethyl alcohol). The lichen substances were identified using standardized thin layer chromatography techniques (TLC) with solvent system C (Orange et al. 2010). These lichens were photographed under OLYMPUS SZX16 and BX61 with DP72.

Taxonomic descriptions

Clauzadea monticola (Ach.) Hafellner & Bellem., Beih. Nova Hedwigia 79: 319 (1984)

FIG. 1

MORPHOLOGY — **THALLUS** granular to almost rimose and superficial, or ± immersed, brownish grey to ochre; medulla I–; prothallus absent. **APOTHECIA** sessile, constricted at the base, not forming pits; disc (0.3–)0.4–0.7(–0.9) mm diam., flat to convex, dark brown to black, becoming brownish when wet, not pruinose; margin slightly raised, generally persistent but sometimes finally excluded. **EXCIPLE** black-brown, 40–50 µm wide, without crystals; **epihymenium** reddish brown, without crystals; **hymenium** hyaline, 65–80 µm tall; **hypothecium** deep red brown, without crystals; **paraphyses** 2–3.5 µm diam., branched and occasionally anastomosing, the apices capitate and widening to 5.0 µm diam. **ASCI** clavate, *Porpidia*-type; **ascospores** hyaline, simple, ellipsoid, 9–12(–13) × 4–5.5 µm, halonate when young, the perispore ≤1.5 µm thick. **PYCNIDIA** not observed.

CHEMISTRY — Thallus and medulla K–, C–, KC–, P–. No lichen substances were detected by TLC.

SPECIMENS EXAMINED: CHINA. XINJIANG, Chabuer, Mt. Wusongshan, alt. 2215 m, on rock, 10 Jun. 2014, P. M. Wang 20140049, 20140022, 20140012 (SDNU).

DISTRIBUTION — *Clauzadea monticola* has been reported from Asia, Africa, Europe, Macaronesia, North and South America, and New Zealand (Thomson 1997, Smith et al. 2009). New from China.

COMMENTS — *Clauzadea monticola* can be most easily distinguished from other *Clauzadea* species by its generally superficial thallus and sessile, epruinose apothecia. It is morphologically similar to *Lecidella stigmathea* and *Farnoldia jurana*, both of which occur in similar habitats. *Lecidella stigmathea* can be separated by its *Lecanora*-type ascus, larger non-halonate ascospores (11–17 × 6–9 µm), and hyaline hypothecium (Thomson 1997), while *F. jurana* differs in its blue-green epihymenium, non-capitate paraphyses, larger apothecia (0.5–1.5 mm), and larger ascospores (13–28 × 7–14 µm; Smith et al. 2009).

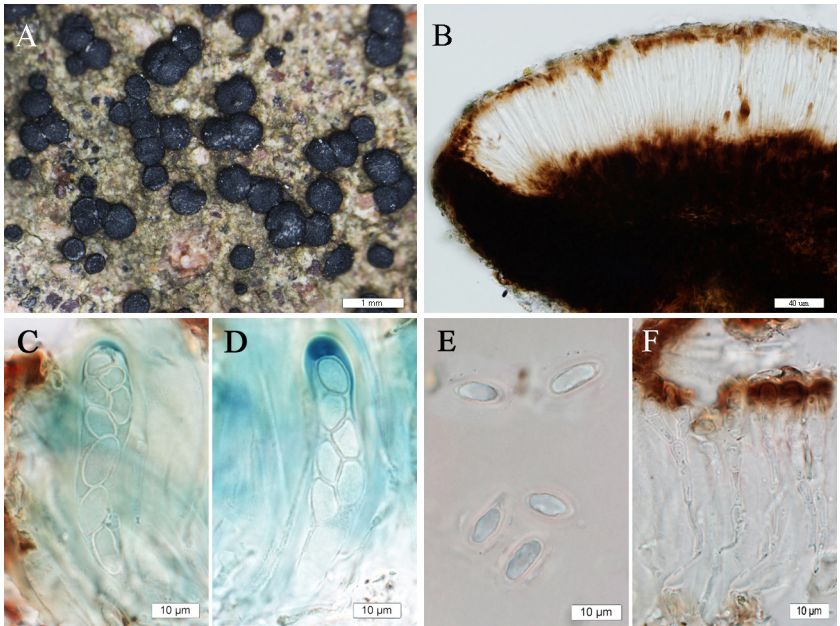


FIG. 1. *Clauzadea monticola* (Wang 20140049, SDNU). A: thallus; B: apothecium section; C: ascus and ascospores; D: amyloid reaction of ascus; E: ascospores; F: paraphyses.

Immersaria iranica Valadb., Sipman & Rambold, Lichenologist 43: 204 (2011) FIG. 2

MORPHOLOGY — **THALLUS** crustose, areolate, 0.3–0.4 mm thick; areoles brown to slightly reddish brown, flat to slightly convex, often with irregular, whitish rims; epinecral layer 15–23 μm high, (pheno-)cortical layer 30–40 μm thick; medulla I+; hypothallus black to grey, frequently visible between the areoles. **APOTHECIA** immersed, 0.3–0.6 mm diam., usually one per areole, round or angular, sometimes surrounded by a white rim, with crypto-lecanorine margin; disc black-brown, plane to weakly convex, epruinose. **EXCIPLE** thin to absent; epihymenium dark brown, 15–20 μm ; hymenium hyaline, 120–150 μm tall; hypothecium hyaline; paraphyses 1.5–3.5 μm diam., anastomosing and apically branched, apical cells widening slightly to 4.5 μm . **ASCI** clavate, *Porpidia*-type; ascospores hyaline, simple, ellipsoid to subglobose, 9–13(–15) $\times$ 5.5–7 μm , halonate. **PYCNIDIA** immersed, opening by $\pm$ stellate winding cracks ≤ 0.5 mm long; conidia clavate to occasionally pyriform, 3–5 $\times$ c. 1.5 μm .

CHEMISTRY — Thallus and medulla K–, C–, KC–, P–. No lichen substances were detected by TLC.

SPECIMENS EXAMINED: CHINA. XINJIANG, Urumqi, Mt. Tianshan-glacier No.1, alt. 3800 m, on rock, 27 Aug. 2011, Z.L. Huang 20126106, 20129049 (SDNU).

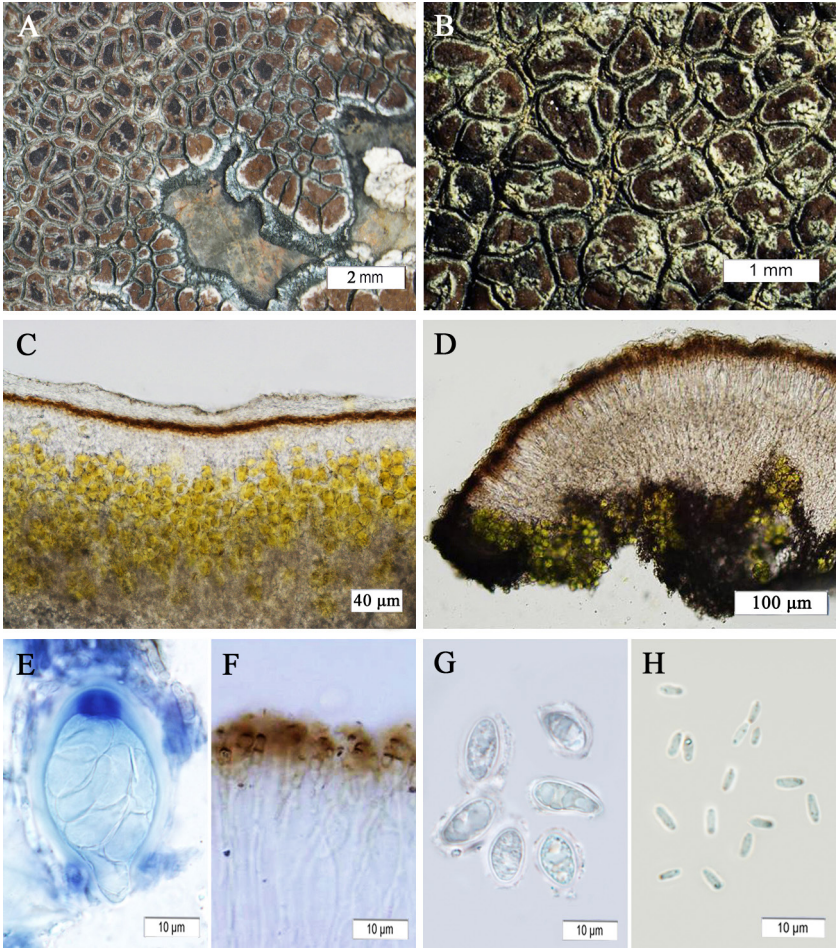


FIG. 2. *Immersaria iranica* (Huang 20126106 SDNU). A: thallus; B: pycnidia; C: thallus section; D: apothecium section; E: amyloid reaction of ascus; F: paraphyses; G: ascospores; H: conidia.

DISTRIBUTION — *Immersaria iranica* has been reported only from Iran (Valadbeigi et al. 2011). New from China.

COMMENTS — *Immersaria iranica* is characterized by the crypto-lecanorine apothecia, the I+ medulla, the pycnidia opening by $\pm$ stellate winding cracks, the round or lobed apothecia, and possession of 2'-O-methylsuperphyllinic acid (Valadbeigi 2011). The Chinese specimens differ in their non-lobed apothecia and lack of secondary substances.

Immersaria usbekica (Hertel) M. Barbero, Nav.-Ros. & Cl. Roux, Bull. Soc. Linn.

Provence 41: 140 (1990)

FIG. 3

MORPHOLOGY — **THALLUS** crustose, cracked-areolate, 0.15–0.5(–0.7) mm thick; areoles yellow-brown, flat to slightly convex; epinecral layer 14–20 μ m high, (pheno-)cortical layer 25–35 μ m thick; medulla I+; hypothallus black, more or less distinct between the areoles. **APOTHECIA** immersed, 0.2–0.5 mm diam., usually one or two per areole, with crypto-lecanorine margin; disc black-brown, plane to weakly concave, epruinose. **EXCIPLE** usually very

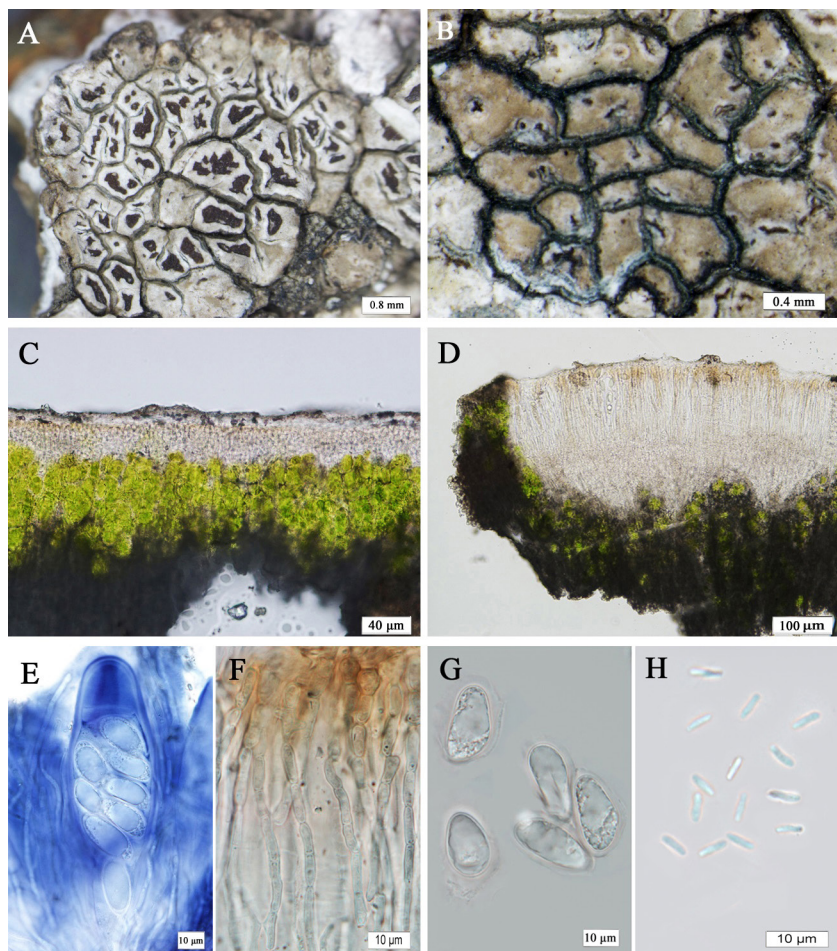


FIG. 3. *Immersaria usbekica* (Li 2013814, SDNU). A: thallus; B: pycnidia; C: thallus section; D: apothecium section; E: amyloid reaction of ascus; F: paraphyses; G: ascospores; H: conidia.

reduced where the apothecia are attached to the areoles and better developed where the apothecia reach the areole margins; epihymenium olive-brown to brown, 17–25 µm, hymenium hyaline, 125–140 µm tall; hypothecium hyaline; paraphyses 2.5–4 µm diam., anastomosing and apically branched, apical cells widening to 5.5 µm. ASCI clavate, *Porpidia*-type; ascospores hyaline, simple, ellipsoid, (15–)18–23 × 9–13 µm, halonate. PYCNIDIA immersed, opening by simple or graphidoid cracks up to 0.25 mm long; conidia short bacilliform, 4.5–6.5 × c. 1.5 µm.

CHEMISTRY — Thallus and medulla K–, C+ pale red, KC+ pale red, P–. Gyrophoric acid and a confluent acid syndrome were detected by TLC.

SPECIMEN EXAMINED: CHINA. XINJIANG, Urumqi, Xishuigou, alt. 1950 m, on rock, 7 Sep. 2013, S.X. Li 2013814 (SDNU).

DISTRIBUTION — *Immersaria usbekica* has been reported from Asia, Europe, and North Africa (Barbero et al. 1990; Hertel 1977, 2001; Valadbeigi et al. 2011). New to China.

COMMENTS — *Immersaria usbekica* is morphologically similar to *I. iranica* but differs by the presence gyrophoric and confluent acids, bacilliform conidia, and calcareous habitat.

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